What is claimed is:

1. An automated microfluidic system that detects a protein in a biological sample, the system comprising:

a cartridge reservoir part including a sample reservoir, a dye reservoir, and a plurality of control reservoirs that contain control solutions of various concentrations of the protein of interest , each of the sample reservoir, the dye reservoir, and the control reservoirs having a hydrophobic upper barrier connected to a compressed-air inlet and a hydrophobic lower barrier connected to a liquid outlet;

a cartridge with a microfluidic channel that includes a sample detection part, a plurality of control detection parts, and a dye/buffer inlet part, each of the sample detection part and the control detection parts that have inlets connected to the liquid outlets of the sample reservoir and control reservoirs, respectively, an outlet, and antibodies immobilized on an inner surface, the dye/buffer inlet part having a dye inlet connected to a liquid outlet of the dye reservoir and a buffer inlet port;

a compressed-air storage tank connected to the compressed-air inlets of the sample reservoir, the dye reservoirs, and the control reservoirs by valves;

a buffer storage tank connected to the buffer inlet ports by valves; and

a reader that measures the degrees of antigen-antibody reactions in the sample and control detection parts based on variations in dye color.

2. The automated microfluidic system of claim 1, wherein the upper hydrophobic barrier and the lower hydrophobic barrier allow only air to pass, not liquid, in an atmospheric pressure.

3. The automated microfluidic system of claim 1, wherein the upper hydrophobic barrier and the lower hydrophobic barrier are porous, and the lower hydrophobic barrier has a larger average pore size than the upper hydrophobic barrier.

4. The automated microfluidic system of claim 3, wherein the upper hydrophobic barrier has an average pore diameter that ranges from 0.2 μ m to 1 μ m, and the lower hydrophobic barrier has an average pore diameter that ranges from 2 μ m to 20 μ m.

5. The automated microfluidic system of claim 1, wherein the upper hydrophobic barrier and the lower hydrophobic barrier are made of porous polytetrafluoro ethylene membranes.

6. The automated microfluidic system of claim 1, further comprising a pump connected to the compressed-air storage tank and the buffer storage tank.

7. The automated microfluidic system of claim 1, wherein the sample detection part and the control detection parts have the same volume.

8. The automated microfluidic system of claim 1, wherein the length of a portion of the microfluidic channel between the dye inlet of the dye/buffer inlet part and the outlet of the sample detection part is equal to the length of a portion of the microfluidic channel between the dye inlet of the dye/buffer inlet part and the outlet of one of the control detection parts.

9. The automated microfluidic system of claim 1, wherein the length of a portion of the microfluidic channel between the buffer inlet port of the dye/buffer inlet part and the outlet of the sample detection part is equal to the length of a portion of the microfluidic channel between the dye inlet of the dye/buffer inlet part and the outlet of one of the control detection parts.

10. The automated microfluidic system of claim 1, wherein the valves that connect the compressed-air inlets and the compressed-air storage tank are three-way valves that are closed to allow external air to flow into the compressed-air inlet ports and are opened toward the compressed-air storage tank.

11. The automated microfluidic system of claim 1, further comprising a controller that controls the opening and closing of the outlets of the sample detection part and the control detection parts.

12. A method of detecting a protein in a biological sample using the automated microfluidic system according to claim 1, the method comprising:

supplying compressed air through the compressed-air inlets to move a

sample in the sample reservoir and controls in the control reservoirs into the sample detection part and the control detection parts, respectively, to induce antigen-antibody reactions therein;

washing the sample detection part and the control detection parts by supplying a buffer through the buffer inlet port;

supplying compressed air through the compressed-air inlets to move a dye in the dye reservoir through the dye/buffer inlet port into the sample detection part and the control detection parts;

washing the sample detection part and the control detection parts by supplying a buffer through the buffer inlet port; and

detecting whether the protein exists in the biological sample and quantitating the protein based on color variation data obtained from the antigen-antibody reactions in the sample detection part and the control detection parts.